

### AMENDMENTS TO THE CLAIMS

This listing of the claims replaces all prior versions and listings of the claims in the Subject Application:

1 - 49. (Canceled)

50. (New) A non-stoichiometric nanomaterial comprising two or more elements having a composition different than that required for stoichiometric bonding between the two or more elements, the composition represented by the formula:



wherein M comprises an element that can lower its free energy by chemically bonding with Z;

wherein Z comprises a chalcogen;

wherein n and p are integers greater than or equal to 1;

wherein  $0.01 < x < 0.99$ ; and

wherein a value for a selected material property of the non-stoichiometric nanomaterial is greater than 10% different from a value for the same property for a stoichiometric form of the nanomaterial.

51. (New) The non-stoichiometric nanomaterial of claim 50, wherein M is selected from the group consisting of: Ti, Mn, Fe, Ni, Zn, Cu, Sr, Y, Zr, Ta, W, Sc, V, Co, In, Li, Hf, Nb, Mo, Sn, Sb, Al, Ce, Pr, Be, Np, Pa, Gd, Dy, Os, Pt, Pd, Ag, Eu, Er, Yb, Ba, Ga, Cs, Na, K, Mg, Pm, Pr, Ni, Bi, Tl, Ir, Rb, Ca, La, Ac, Re, Hg, Cd, As, Th, Nd, Th, Md, and Au.

52. (New) The non-stoichiometric nanomaterial of claim 50, wherein  $0.02 < x < 0.98$ .

53. (New) The non-stoichiometric nanomaterial of claim 50, wherein  $0.05 < x < 0.95$ .

54. (New) The non-stoichiometric nanomaterial of claim 50, wherein the domain size of the material is less than 5 times the mean free path of electrons in the material.

55. (New) The non-stoichiometric nanomaterial of claim 50, wherein the domain size of the material is less than 100 nanometers.

56. (New) The non-stoichiometric nanomaterial of claim 50, wherein the nanomaterial comprises two or more elements M that can lower their free energy by chemically bonding with Z.

57. (New) The non-stoichiometric nanomaterial of claim 50, wherein the nanomaterial comprises more than one element Z.

58. (New) The non-stoichiometric nanomaterial of claim 50, wherein the nanomaterial comprises more than one element M and more than one element Z.

59. (New) The non-stoichiometric nanomaterial of claim 50, wherein the nanomaterial comprises a multimetallic nanopowder having an aspect ratio in a range of 1-25.

60. (New) The non-stoichiometric nanomaterial of claim 50, wherein the nanomaterial comprises a polymetallic nanopowder comprising at least three metals and at least one chalcogen anion, and having a minimum dimension of less than 100 nm and an aspect ratio of 25 or less.

61. (New) The non-stoichiometric nanomaterial of claim 50, wherein the nanomaterial comprises a nanofiller dispersed in a polymer matrix, thereby forming a nanostructured composite material.

62. (New) A coating composition comprising the non-stoichiometric nanomaterial of claim 50.

63. (New) A nanostructured composite material comprising:  
a polymer matrix; and  
a nanofiller dispersed in the polymer matrix;  
wherein the nanofiller comprises a non-stoichiometric nanomaterial comprising two or more elements having a composition different than that required for stoichiometric bonding between the two or more elements, the composition represented by the formula:



wherein M comprises an element that can lower its free energy by chemically bonding with Z;

wherein Z comprises a chalcogen;

wherein n and p are integers greater than or equal to 1; and

wherein  $0.01 < x < 0.99$ ; and

wherein a value for a selected material property of the nanostructured composite material comprising the nanofiller is at least 20% different from a value for the same property for an otherwise identical composite material comprising a micron-scale filler.

64. (New) The nanostructured composite material of claim 64, wherein the nanofiller comprises a polymer coated nanofiller.

65. (New) The nanostructured composite material of claim 64, wherein the nanofiller comprises a monomer coated nanofiller.

66. (New) The nanostructured composite material of claim 64, wherein the composite material comprises a coating composition.

67. (New) The nanostructured composite material of claim 64, wherein M is selected from the group consisting of: Ti, Mn, Fe, Ni, Zn, Cu, Sr, Y, Zr, Ta, W, Sc, V, Co, In, Li, Hf, Nb, Mo, Sn, Sb, Al, Ce, Pr, Be, Np, Pa, Gd, Dy, Os, Pt, Pd, Ag, Eu, Er, Yb, Ba, Ga, Cs, Na, K, Mg, Pm, Pr, Ni, Bi, Tl, Ir, Rb, Ca, La, Ac, Re, Hg, Cd, As, Th, Nd, Th, Md, and Au.

68. (New) The nanostructured composite material of claim 64, wherein  $0.02 < x < 0.98$ .

69. (New) The nanostructured composite material of claim 64, wherein  $0.05 < x < 0.95$ .

70. (New) The nanostructured composite material of claim 64, wherein the domain size of the material is less than 5 times the mean free path of electrons in the material.

71. (New) The nanostructured composite material of claim 64, wherein the domain size of the material is less than 100 nanometers.

72. (New) The nanostructured composite material of claim 64, wherein the nanomaterial comprises two or more elements M that can lower their free energy by chemically bonding with Z.

73 (New) The nanostructured composite material of claim 64, wherein the nanomaterial comprises more than one element Z.

74. (New) The nanostructured composite material of claim 64, wherein the nanomaterial comprises more than one element M and more than one element Z.

75. (New) The nanostructured composite material of claim 64, wherein the nanomaterial comprises a multimetallic nanopowder having an aspect ratio in a range of 1-25.

76. (New) The nanostructured composite material of claim 64, wherein the nanomaterial comprises a polymetallic nanopowder comprising at least three metals and at least one anion, and having a minimum dimension of less than 100 nm and an aspect ratio of 25 or less.

77. (Withdrawn-New) A non-stoichiometric nanomaterial comprising two or more elements having a composition different than that required for stoichiometric bonding between the two or more elements, the composition represented by the formula:



wherein M comprises an element that can lower its free energy by chemically bonding with Z;

wherein Z comprises an element selected from the group consisting of B, C, Si, N, P, O, S, Se, Te, and H;

wherein n and p are integers greater than or equal to 1;

wherein  $0 < x < 1$ ; and

wherein a value for a selected material property of the non-stoichiometric nanomaterial is greater than 10% different from a value for the same property for a stoichiometric form of the nanomaterial.

78. (*Withdrawn-New*) A nanostructured composite material comprising:  
a polymer matrix; and  
a nanofiller dispersed in the polymer matrix;  
wherein the nanofiller comprises a non-stoichiometric nanomaterial comprising two or more elements having a composition different than that required for stoichiometric bonding between the two or more elements, the composition represented by the formula:



wherein M comprises an element that can lower its free energy by chemically bonding with Z;

wherein Z comprises an element selected from the group consisting of B, C, Si, N, P, O, S, Se, Te, and H;

wherein n and p are integers greater than or equal to 1;

wherein  $0 < x < 1$ ; and

wherein a value for a selected material property of the nanostructured composite material comprising the nanofiller is at least 20% different from a value for the same property for an otherwise identical composite material comprising a micron-scale filler.